# The Restraint of Children in Aircraft

Roger Hardy

Cranfield Impact Centre Ltd.

# Cranfield Impact Centre Research

- Much of the Research was sponsored by UK Civil Aviation Authority (CAA)
- Lead to the use of forward facing Child Restraint Devices (CRDs) on UK registered aircraft
- Provided background information to assist harmonisation of National Aviation rules into Joint Aviation Authority (JAA) rules

# Cranfield Impact Centre Research

- 1998 programme supported by DG VII of European Commission to write a draft European Performance Specification for Child Restraint Systems in Passenger Aircraft (IMPCHRESS)

# Current Situation

6 month ATD on adult ATD lap

# Current Situation

3 year ATD, representing 2 year, on adult lap

# Current Situation


Belted child ATD on adult lap

# Current Situation

Braced child and adult ATDs

# Comments on lap carrying

- Children on adults laps' are not afforded the same level of protection as an adult
- Children on adults laps' can be injured by the adult during an impact
- Parent's 'super-human' strength DOES NOT allow them to hold onto a child during an impact

- CONCLUSION

  CHILDREN SHOULD NOT BE CARRIED ON LAP

# Children on aircraft seats

6 year ATD on seat

# Children on aircraft seats


3 year ATD on seat


6 year ATD on seat

# Multiple Occupancy of a Seat


Two 3 year ATDs


3 and 6 year ATDs

# Multiple Occupancy of a Seat

3 and 10 year ATDs


belt routing

# Multiple Occupancy of a Seat - test result

damaged 3 year ATD


release lever position

# Child Safety in Aircraft

What must we achieve?

- The safe restraint of children at least to the same standard as other passengers

How?

- Use a restraint system suitable for the age and weight of the child

# Child Safety in Aircraft

- Forward facing CRDs allowed in some European countries, United States, Canada and some other countries
- Rearward facing CRDs allowed in United States, Canada and some other countries *but NOT in Europe*
  - European Auto rule (ECE Reg. 44) has generally the same limits on the allowed forward head motion of test dummy in forward and rearward facing **CRDs**

# Child Restraints
# - rearward facing


lap belt only


post test deformation

# Child Restraints
# - forward facing


buckle under seat shell

snared belt webbing

# Seat back interaction

# Issues in approving use and performance of CRDs

- fit of CRD to aircraft seat
- restraint of CRD by aircraft seat belt
- dynamic test performance of CRD
- dynamic test pass/fail criteria
- relevance of dynamic test set-up to aircraft cabin environment

# IMPCHRESS Study

- reviewed current status of world-wide automotive and aviation regulations governing the restraint of children
- consulted industry and consumers organisations on their views
- reviewed technical status of existing regulations and the methods used to approve CRDs
- wrote a draft European Performance Specification for Child Restraint Systems in Passenger Aircraft

# IMPCHRESS Study - Performance Specification

- is compatible with European Auto regulation (ECE Reg. 44)
- where possible, it is aligned with the draft SAE AS 5276/1
- is for approving CRDs for passengers below 18kg
- all types of restraints are permitted, if they meet all the assessment criteria

# IMPCHRESS Study - Performance Specification

- **due to the different risk profiles, two classes of restraint are recommended**
  - Class A for all phases of flight including take-off and landing
  - Class B only for in-flight use, including turbulence
- **the test fixture is based on an economy class seat with a near minimum seat pitch**

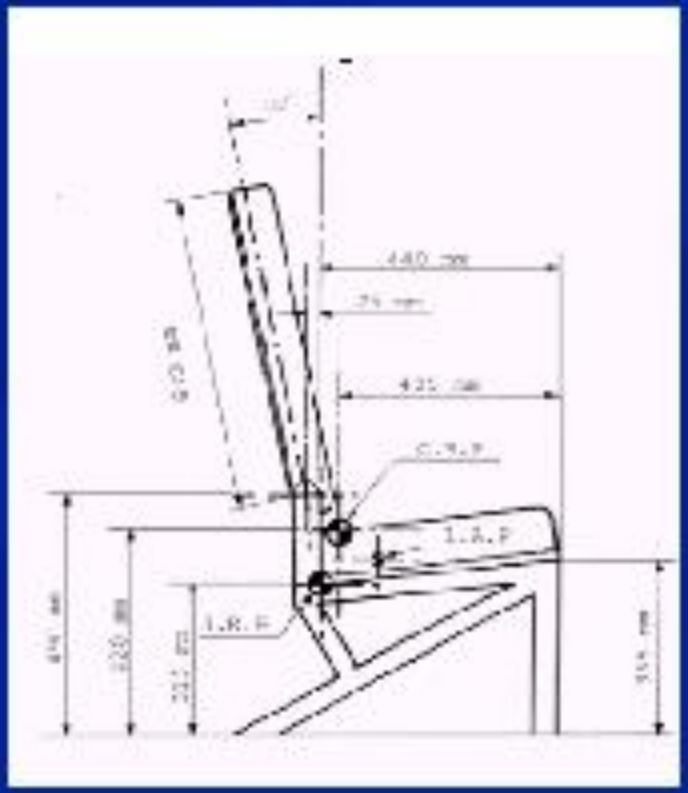
# IMPCHRESS Study - Performance Specification

- restraints recommended

| PASSENGER GROUP | RESTRAINT TYPE | MASS (kg) | RESTRAINT DESCRIPTION | |
|---|---|---|---|---|
| | | | CLASS 'A' | CLASS 'B' |
| New Born | I | Less than 5 | Aft-facing (reclining) CRD | Supplementary belt or other approved CRD |
| Infant | II | 5 - 10 | Aft-facing (reclining) CRD | Supplementary belt or other approved CRD |
| Toddler | III | 9 - 18 | Forward or Aft facing (upright) CRD | Supplementary belt or other approved CRD |
| Child/Adult | | Over 18 | Standard lap belt | Standard lap belt |

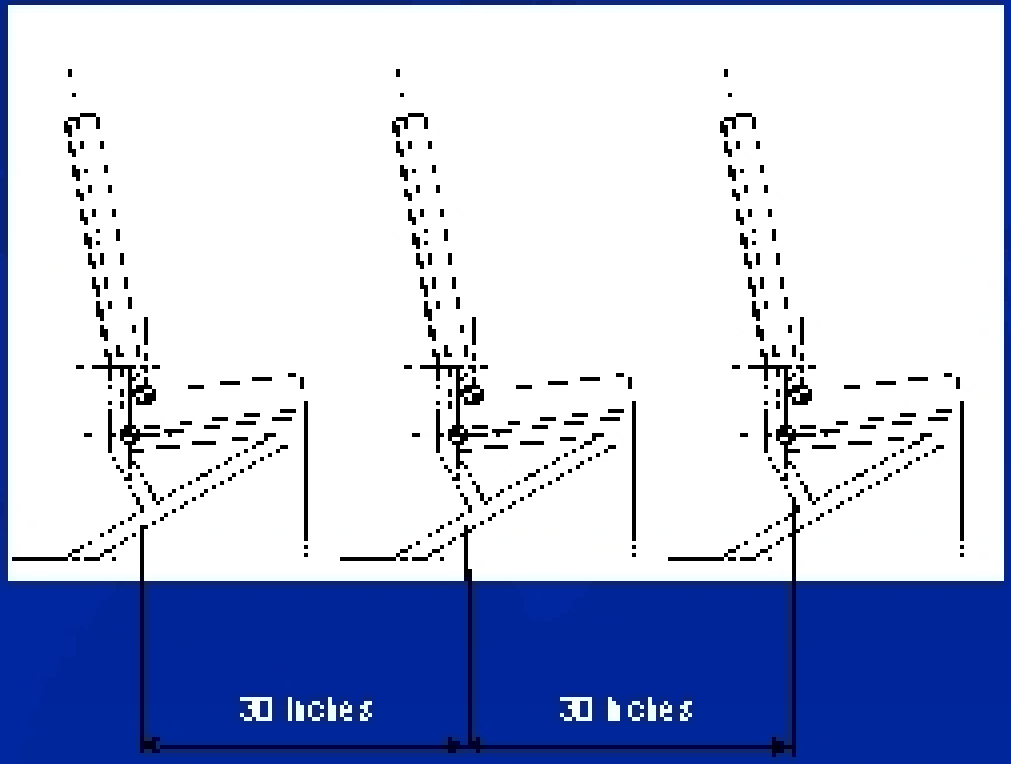
# IMPCHRESS Study - Performance Specification

- recognition of aircraft seat construction



# IMPCHRESS Study - Performance Specification

- recognition of aircraft cabin environment



# Any Questions?

Roger Hardy
Cranfield Impact Centre Ltd.
Wharley End, Cranfield
Bedford, MK43 0JR
United Kingdom
Tel: +44 1234 756508
Fax: +44 1234 750944
E-mail: r.n.hardy@cranfield.ac.uk
Web site: www.cid.co.uk